

University of Groningen

## Functional polymers from alternating aliphatic polyketones

Toncelli, Claudio

**IMPORTANT NOTE:** You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2013

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Toncelli, C. (2013). *Functional polymers from alternating aliphatic polyketones: synthesis and applications*. s.n.

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

# **Functional Polymers from Alternating Aliphatic Polyketones: Synthesis and Applications**

**Claudio Toncelli**

The work described in this thesis was conducted at the Department of Chemical Engineering, University of Groningen, Groningen, The Netherlands.

Printing of this thesis was financially supported by:  
Institute of Technology and Management, Department of Chemical Engineering, University of Groningen, The Netherlands.

Cover design: Alexandra Protsenko

**Copyright ©2013 by Claudio Toncelli. All right reserved.**

No part of this book may be reproduced or transmitted in any form or by any means without written permission of the author.

ISBN: 978-90-367-6206-9

ISBN (e-book): 978-90-367-6205-2

**Printed by Wöhrmann Print Service B.V**

**RIJKSUNIVERSITEIT GRONINGEN**

**Functional Polymers from Alternating Aliphatic Polyketones:**

**Synthesis and Applications**

**Proefschrift**

ter verkrijging van het doctoraat in de  
Wiskunde en Natuurwetenschappen  
aan de Rijksuniversiteit Groningen  
op gezag van de  
Rector Magnificus, dr. E. Sterken,  
in het openbaar te verdedigen op  
vrijdag 7 juni 2013  
om 14.30 uur

door

**Claudio Toncelli**

geboren op 1 september 1982

te Pontedera, Italië

Promotores:                    Prof. dr. F.Picchioni  
                                      Prof. dr. A.A.Broekhuis

Beoordelingscommissie:    Prof. dr. F.Ciardelli  
                                      Prof. dr. K. Loos  
                                      Prof. dr. H.J. Heeres

ISBN: 978-90-367-6206-9

ISBN (e-book): 978-90-367-6205-2

# Dedicated to my beloved mother

Little by little  
I've come to this point  
on my own I've been searching my way  
I lost you so early  
the days went so fast  
you don't know I prayed every day

a song to remember  
a song to forget  
you'll never know how I tried  
to make you proud  
and to honor your name but  
you never told me goodbye

now that you are gone  
casting shadows from the past  
you and all the memories will last



## Contents

<b>Chapter 1</b>	Introduction	1
<b>Chapter 2</b>	Polycations bearing charged aromatic groups and their interaction with 5,10,15,20-tetrakis-(4-sulfonatophenyl)-porphyrin	13
<b>Chapter 3</b>	Properties of reversible Diels-Alder furan/maleimide polymer networks as function of cross-linking density	31
<b>Chapter 4</b>	Cyclopentadiene-functionalized polyketone as self-cross-linking reversible thermoset	49
<b>Chapter 5</b>	Structure-performance relationship in metal ion uptake of chemically modified alternating aliphatic polyketones	67
<b>Chapter 6</b>	The kinetics of Paal-Knorr reaction in polyketone-based materials as tuning tool for electro-deposition coatings	99
	Summary	117
	Samenvatting	121
	Acknowledgements	125
	Curriculum vitae	127



